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said cooled rollers being configured to sufficiently cool and compress said commingled threads deposited onto said conveyor to become rigid and non-porous, thereby forming a rigid non-porous composite material capable of being molded; and

an automatic guillotine device positioned and configured to cut the rigid non-porous composite product,

wherein said glass filaments deposited in said process in total comprise more than 40 % by weight of said glass filaments and said filaments of thermoplastic organic material deposited in said process.

REMARKS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1 and 5-14 are presently pending in this application, Claims 1, 8, 9, 10, 13 and 14 having been amended by the present amendment.

In the outstanding Office Action, Claims 1 and 5-14 were rejected under 35 U.S.C. §103(a) as being unpatentable over Francis (U.S. Patent 2,543,101) in view of O'Conner (U.S. Patent 4,800,113), and alternatively further in view of PCT WO 90/14457 (hereinafter "WO '457").

First, Applicants acknowledge with appreciation the courtesy of a personal interview granted to Applicants' attorney on January 24, 2002, during which patentability of the outstanding claims were discussed. In particular, Applicants submitted that Francis employs air blowers to heat and cool a product for consolidation, thereby producing a porous product. Also, Applicants submitted that although the rollers 28, 29 in Francis may be able to apply a certain degree of compacting pressure to reduce the product until certain thickness and

density while heating, the product after the heating process still maintains porosity sufficient for cooling executed by the cooling blower 31 and suction 32. Furthermore, Claim 1 has been amended to partially incorporate the subject matter recited in Claim 8. In particular, Claim 1 has been amended to recite to the effect that both the strip of fabric and plurality of continuous threads are made from the same intimately blended commingled threads.

Also, Claims 1, 8, 9, 10, 13 and 14 have been amended to clarify their subject matters.

Briefly, Claim 1 of the present invention is directed to a method for continuously manufacturing a composite product including preparing intimately blended commingled threads containing glass filaments and filaments of thermoplastic organic material, providing a strip of fabric made from the intimately blended commingled threads and a plurality of continuous threads including at least 80% by weight of the intimately blended commingled threads, continuously depositing onto a moving conveyor two layers, one of the two layers including the plurality of continuous threads in a form of at least one of continuous threads continuously deposited in a direction of movement of the moving conveyor, continuous threads continuously deposited in a form of superposed loops and continuous threads continuously deposited in a form of chopped threads, and the other one of the two layers including the strip of fabric, continuously transferring the two layers combined through a plurality of zones where the two layers are heated and cooled while being sufficiently compressed to form a continuous rigid non-porous composite material capable of being molded, and at least one of cutting up the rigid non-porous continuous composite material into a plurality of sheets and sufficiently softening the continuous rigid non-porous composite material to wind onto a rotating drum. According to Claim 1, the glass filaments deposited in the process in total comprise more than 40 % by weight of the glass filaments and the filaments of thermoplastic organic material deposited in the process.

By preparing such intimately blended commingled threads, providing such a strip of fabric and continuous threads, and continuously depositing the two layers containing glass threads and thermoplastic organic material as such, not only a rigid non-porous composite material whose content of reinforce fibers is exceedingly high can be continuously manufactured,¹ but also a high content of reinforcing fibers can be readily promoted evenly throughout the rigid non-porous composite product. As a result, rigid non-porous continuous composite products manufactured have strength which is equal or higher than those manufactured simply by increasing glass content.²

Francis discloses a method for manufacturing a composite product having a layer of prefabricated textile material and a layer of felt-like material.³ However, Francis does not teach the providing and continuously depositing steps, wherein the glass filaments deposited in the process in total comprise more than 40 % by weight of the glass filaments and the filaments of thermoplastic organic material deposited in the process as recited in Claim 1. Instead, Francis simply discloses depositing and bonding "non-adhesive fibers" onto a textile fabric by using "potentially adhesive fibers", e.g., thermoplastic material, thereby making a felt-like product whose one surface is exposed and the other surface is securely anchored to a textile layer.⁴ Although there are numerous ways to manufacture a composite product by depositing and bonding non-adhesive and adhesive fibers, the only guidance Francis provides is as follows:

¹ Specification, page 15, lines 7-11.

² Id. lines 28-38.

³ Francis, column 1, lines 1-7.

⁴ Id.

"[w]hen a greater degree of strength or a closer bonding of the component fibers is desired, their percentage may be relatively high, whereas in soft felts in which it is desirable to have a comparatively small amount of bonding of the component fibers, the percentage will be relatively small."⁵

Nowhere does Francis suggest or disclose providing the strip of fabric and continuous threads as recited in Claim 1 and continuously depositing two layers, one including the continuous threads and the other including the strip of fabric as recited in Claim 1 such that a reinforced thermoplastic composite is continuously manufactured while effectively ensuring good bonding between the glass filaments and the thermoplastic organic material filaments and a high glass fiber content evenly throughout the reinforced thermoplastic composite.

Accordingly, the process disclosed in Claim 1 is distinguishable from Francis.

The outstanding Office Action asserts that O'Connor discloses utilizing commingled fibers in the composite article manufacture. However, O'Connor does not teach the providing and continuously depositing steps, wherein the glass filaments deposited in the process in total comprise more than 40 % by weight of the glass filaments and the filaments of thermoplastic organic material deposited in the process. On the contrary, the O'Connor method only discloses "intermingling" filaments of thermoplastic and continuous filaments of reinforcing fibers, weaving these filaments into a fabric, and heating the fabric.⁶ O'Connor therefore does not disclose providing a strip of fabric and a plurality of continuous threads as recited in Claim 1. Nor does O'Connor disclose continuously depositing two layers, one of the two layers including the plurality of continuous threads in a form of at least one of continuous threads continuously deposited in a direction of movement of the moving

⁵ Id.

⁶ O'Conner, columns 6-7.

conveyor, continuous threads continuously deposited in a form of superposed loops and continuous threads continuously deposited in a form of chopped threads, and the other one of the two layers including the strip of fabric. As such, O'Connor does not disclose the adequate contact between the strip of fabric and the layer made of at least one of the continuous threads disclosed by Applicants. Accordingly, the process recited in Claim 1 is clearly distinguishable from O'Connor.

Likewise, WO '457 discloses a method for producing a fiber reinforced plastic material, but does not teach the providing and continuously depositing step, wherein the glass filaments deposited in the process in total comprise more than 40 % by weight of the glass filaments and the filaments of thermoplastic organic material deposited in the process as discussed above. Thus, the process recited in Claim 1 is also distinguishable from WO '457.

Since none of Francis, O'Conner and WO '457 teaches the proving and continuously depositing step, wherein the glass filaments deposited in the process in total comprise more than 40 % by weight of the glass filaments and the filaments of thermoplastic organic material deposited in the process as recited in Claim 1, even the combined teachings of these cited references would not render the process recited in Claim 1 obvious.

Since independent Claims 13 and 14 include subject matter substantially incorporating what is recited in Claim 1, Claims 13 and 14 are also distinguishable from Francis, O'Conner and WO '457.

For the foregoing reasons, Claims 1, 13 and 14 are believed to be allowable. Furthermore, because Claims 5-12 ultimately depend from Claim 1 and contain limitations not taught by the references of record, substantially the same arguments set forth above also apply to these dependent claims. Hence, Claims 5-12 are believed to be allowable as well.

In view of the amendment and discussions presented above, it is respectfully submitted that the present application is in condition for allowance, and an early action favorable to that effect is earnestly solicited.

Respectfully submitted,

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IN THE CLAIMS

Please amend Claims 1, 8, 9, 10, 13 and 14 as follows:

--1. (Six Times Amended) A process for continuously manufacturing a rigid non-porous composite product [by associating glass threads and a thermoplastic organic material in a filamentary state], comprising the steps of:

preparing intimately blended commingled threads containing glass filaments and filaments of thermoplastic organic material;

providing a strip of fabric [formed by glass threads including at least a portion of] made from the intimately blended commingled threads [containing glass filaments and filaments of thermoplastic organic material,] and a plurality of continuous threads including at least 80% by weight of the intimately blended commingled threads [containing glass filaments and filaments of thermoplastic organic material];

continuously depositing onto a moving conveyor two layers, one of the two layers including said plurality of continuous threads in a form of at least one of continuous threads continuously deposited in a direction of movement of said moving conveyor, continuous threads continuously deposited in a form of superposed loops and continuous threads continuously deposited in a form of chopped threads, and the other one of the two layers including said strip of fabric;

continuously transferring said two layers combined through a plurality of zones where said two layers are heated and cooled while being [simultaneously] sufficiently compressed to form a continuous rigid non-porous composite material capable of being molded; and

at least one of cutting up said rigid non-porous continuous composite material into a plurality of sheets and [winding] sufficiently softening said continuous rigid non-porous composite material to wind onto a rotating drum,

wherein said glass filaments deposited in said process in total comprise more than 40 % by weight of said glass filaments and said filaments of thermoplastic organic material deposited in said process.

8. (Four Times Amended) A process according to Claim 7, wherein:

said one of the two layers is continuously deposited on said moving conveyor and is formed of said chopped threads;

said other one of the two layers is continuously deposited on said one of the two layers and is formed exclusively by said intimately blended commingled threads;

a third layer of chopped intimately blended commingled threads of glass filaments and filaments of a thermoplastic organic material is continuously deposited onto said other one of the two layers;

a combination of said two layers and said third layer thus formed is continuously transferred into a first zone where said combination is heated and then into a second zone where said combination is [simultaneously] sufficiently compressed and heated to become rigid and non-porous;

said combination is then continuously transferred into a third zone where said combination is sufficiently compressed and cooled to become rigid and non-porous, thereby forming a continuous rigid non-porous composite material capable of being molded; and

said [combination thus cooled] continuous rigid non-porous composite material is cut up at an exit of the third zone.

9. (Four Times Amended) A process according to Claim 7, wherein:

said other one of the two layers is continuously deposited on said moving conveyor and is formed exclusively of said intimately blended commingled threads;

said one of the two layers is continuously deposited on said other [layer] one of the two lyears and is formed of said chopped threads;

a third layer exclusively formed by intimately blended commingled threads of glass filaments and filaments of a thermoplastic organic material is continuously deposited onto said one of the two layers;

a fourth layer of chopped intimately blended commingled threads of glass filaments and filaments of a thermoplastic organic material is continuously deposited onto said third layer;

a combination of said two layers, said third layer and said fourth layer thus formed is continuously transferred into a first zone where said combination is heated, and then into a second zone where said combination is [simultaneously] sufficiently compressed and heated to become rigid and non-porous;

said combination is continuously transferred into a third zone where said combination is sufficiently compressed and cooled to become rigid and non-porous, thereby forming a continuous rigid non-porous composite material capable of being molded; and

the [combination thus cooled] continuous rigid non-porous composite material is cut up at an exit of the third zone.

10. (Four Times Amended) A process according to Claim 7, wherein:

said other one of the two layers is continuously deposited onto said moving conveyor and is formed exclusively by said intimately blended commingled threads;

said one of the two layers is continuously deposited on said other one of the two layers [and is formed of at least one continuous commingled thread containing glass filaments and filaments of a thermoplastic organic material];

 a third layer formed exclusively by commingled threads of glass filaments and filaments of a thermoplastic organic material is continuously deposited onto said one of the two layers,

 a fourth layer is continuously deposited on said third layer, said fourth layer being formed of commingled threads of glass filaments and filaments of a thermoplastic organic material;

 a combination of said two layers, said third layer and said fourth layer thus formed is continuously transferred into a first zone where said combination is heated, and then into a second zone where said combination is [simultaneously] sufficiently compressed and heated to become rigid and non-porous;

 said combination is continuously transferred into a third zone where said combination is sufficiently compressed and cooled to become rigid and non-porous, thereby forming a continuous rigid non-porous composite material capable of being molded; and

 the [combination thus cooled] continuous rigid non-porous composite material is cut up at an exit of the third zone.

13. (Four Times Amended) A device for manufacturing a rigid non-porous composite product [obtained by associating glass threads and a thermoplastic organic material in a filamentary state], comprising:

 a storage device for a plurality of windings of commingled threads containing glass filaments and filaments of a thermoplastic organic material;

 a cutter fed with a plurality of continuous threads extracted from said windings;

 at least one device positioned and configured to transfer, store, and distribute said commingled threads chopped by said cutter in a form of a sheet;

at least one barrel supporting at least two rolls of fabric made of said commingled threads; a conveyor positioned and configured to receive said commingled threads thus chopped and a strip of said fabric;

a preheating oven placed at an end portion of the conveyor;

a twin-belt press including a plurality of heating drums in an upstream portion of said twin-belt press and a plurality of cooled rollers in a downstream portion and a central portion of said twin-belt press, said heating drums being configured to sufficiently heat and compress said commingled threads chopped and said strip of fabric to become rigid and non-porous, and said cooled rollers being configured to sufficiently cool and compress said commingled threads chopped and said strip of fabric to become rigid and non-porous, thereby forming a rigid non-porous composite material capable of being molded; and

an automatic guillotine device positioned and configured to cut the rigid non-porous composite product,

wherein said glass filaments deposited in said process in total comprise more than 40 % by weight of said glass filaments and said filaments of thermoplastic organic material deposited in said process.

14. (Four Times Amended) A device for manufacturing a rigid non-porous composite product [obtained by associating glass threads and a thermoplastic organic material in a filamentary state], comprising:

a storage device for a plurality of windings of commingled threads containing glass filaments and filaments of a thermoplastic organic material;

a conveyor positioned and configured to receive the commingled threads deposited in a form of at least one of strips of fabric, continuous threads and chopped threads;

a first barrel disposed upstream of said conveyor and supporting at least two rolls of fabric made of said commingled threads;

at least one distribution device configured to distribute said commingled threads in a form of continuous threads, said at least one distribution device being disposed above said conveyor;

a second barrel disposed downstream of said conveyor and supporting at least two rolls of fabric made of said commingled threads;

at least one of a second distribution device configured to distribute said continuous thread and a cutter followed by a third distribution device configured to distribute said continuous threads chopped by said cutter;

a preheating oven placed at an end portion of the conveyor; and

a twin-belt press including a plurality of heating drums in an upstream portion of said twin-belt press and a plurality of cooled rolls in a downstream portion and a central portion of said twin-belt press, said heating drums being configured to sufficiently heat and compress said commingled threads deposited onto said conveyor to become rigid and non-porous, and said cooled rollers being configured to sufficiently cool and compress said commingled threads deposited onto said conveyor to become rigid and non-porous, thereby forming a rigid non-porous composite material capable of being molded; and

an automatic guillotine device positioned and configured to cut the rigid non-porous composite product,

wherein said glass filaments deposited in said process in total comprise more than 40 % by weight of said glass filaments and said filaments of thermoplastic organic material deposited in said process.--